

Like many geniuses, theoretical physicist John Bell's name is practically unknown to the general public. His "inequality" theorem from 1964 was described by particle physicist Henry Stapp as "the most profound discovery of science." Using ingenious mathematics (what else?!), Bell was able to bring two "common sense" keystones of our understanding of the physical world into direct conflict and show that both could not be true. Therefore, one of the foundations of physics must be removed from the edifice it supports, and that means that everything changes because the old building of physics can no longer stand. The two critical principles that Bell brought into opposition were: 1) The objective, external world, independent of our observations. 2) "Locality": no signal can be passed between two points faster than the speed of light.

Bell's inequality invites us to abandon objective reality or locality. So, what's it to be? Bell commented, "I think it's a deep dilemma, and the resolution of it will not be trivial; it will require a substantial change in the way we look at things. But I would say that the cheapest resolution is something like going back to relativity as it was before Einstein, when people like Lorentz and Poincaré thought that there was an aether – a preferred frame of reference – but that our measuring instruments were distorted by motion in such a way that we could not detect motion through the aether. Now, in that way you can imagine that there is a preferred frame of reference, and in this preferred frame of reference things do go faster than light. But then in other frames of reference when they seem to go not only faster than light but backwards in time, that is an optical illusion. ... Revolutionary or reactionary, make your choice. But that is certainly the cheapest solution. Behind the apparent Lorentz invariance of phenomena, a deeper level is not Lorentz invariant. ...

What is not sufficiently emphasized in textbooks, in my opinion, is that the pre-Einstein position of Lorentz and Poincaré, Larmor and Fitzgerald was perfectly coherent, and is not inconsistent with relativity theory. The idea that there is an aether, and that Fitzgerald contractions and Larmor dilations occur, and that as a result the instruments do not detect motion through the aether – that is a perfectly coherent point of view."

The fact that an alternative version of relativity theory exists that is completely consistent with the enormous amount of experimental support for Einstein's relativity theory is entirely ignored in mainstream scientific thinking and unknown to the general public. This is a classic example of paradigm thinking in science. Einstein's position has become the establishment view while the alternative view is left to wither on the vine, receiving no attention or development. It cannot be stressed enough that

Einstein never at any time disproved the existence of the aether. All he did was remove it from his theory as an unnecessary hypothesis with no observable consequences.

Paul Davies, in his interview with Bell, said of the rival relativity theory (based on the aether), "And it was abandoned on the grounds of elegance?" Bell replied, "Well, on the grounds of philosophy; that what is unobservable does not exist. And also on the grounds of simplicity, because Einstein found that the theory was both more elegant and simpler when we left out the idea of the aether. ... The reason I want to go back to the idea of an aether here is because in these EPR experiments there is the suggestion that behind the scenes something is going faster than light. Now if all Lorentz frames are equivalent, that also means that things can go backward in time. ... It introduces great problems, paradoxes of causality and so on. And it's precisely to avoid these that I want to say there is a real causal sequence which is defined in the aether. Now the mystery is, as with Lorentz and Poincaré, that this aether does not show up at the observational level. It is as if there is some kind of conspiracy, that something is going on behind the scenes which is not allowed to appear on the scenes. And I agree that that's extremely uncomfortable."

Ironically, as Bell observed, it was Einstein's own theory that threw a question mark over objective reality. Einstein was sure that quantum mechanics couldn't be the final truth and there must be an objective underlying reality rather than probabilistic fuzziness ("God does not play dice," as Einstein famously said). However, even more than fuzziness, Einstein was opposed to any faster-than-light signalling. Both of the views Einstein wished to champion (objective reality and light speed as the invariant cosmic speed limit) are, as Bell's Inequality demonstrates, incompatible. This is not speculation. This is a simple, proven fact. Bell, if forced into a choice, made it clear that he would rather sacrifice locality than objective reality, in which case there is something fundamentally wrong with relativity theory as propounded by Einstein. Some signals can travel faster than light, and without going back in time.

Bell said, "One wants to be able to take a realistic view of the world, to talk about the world as if it is really there, even when it is not being observed. I certainly believe in a world that was here before me, and will be here after me, and I believe that you are part of it! And I believe that most physicists take this point of view when they are being pushed into a corner by philosophers."

Paul Davies provided an extraordinary reply, which sums up much of what is wrong with the scientific view of the world: "But it's always seemed to me that the practice of physics is merely creating models which describe the observations that we can make on the world, and relate them together, and we have either good models or less good models, depending on how successful they are. The idea of the world 'really existing', and our theories somehow being 'right' or 'wrong' as being approximations to this reality, I think is not a very helpful one." Here we see the classic "instrumentalist" doctrine of science. Getting the "right" answers is the important thing; not understanding "reality". No instrumentalist seems to be overly concerned with what the "right" answer actually means, and whether it's intrinsically tied to reality or not.

Scientists don't care about truth. They are interested in utility. The "right" answer is useful; the wrong answer isn't. The right answer vindicates the theoretical model, so this model, this paradigm, becomes de facto "reality". This attitude demonstrates how right Thomas Kuhn was to attack the paradigm thinking of scientists. They start questioning their model only when it consistently generates wrong answers (anomalies). John Bell, sadly dead now, was a philosophical scientist, genuinely interested in truth and reality. Such scientists are increasingly rare. Careerist instrumentalists make up the vast bulk of the scientific "church".

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"The interaction between the mind and the rest of the world, how does that occur? Does that occur over a finite region of space, at an instant of time? Clearly not, because that is not a Lorentz invariant concept." – John Bell

"By Lorentz invariant you mean that it doesn't have a consistent description for all observers depending on how they're moving?" -- P.C.W. Davies

"That's correct. And the only way to get such a consistent description, if you assume the mind has access to a single point in time, is to assume it has access to only a single point in space." – John Bell

"This is the big difficulty that there has always been with mind; that it can't be located anywhere in space, and yet one presumably wants it to be located in time." – P.C.W. Davies

“Absolutely, and yet Wigner wants somehow to couple that up into the equations of physics.” – John Bell

This is a somewhat odd debate because the quantum mechanical wavefunction itself is nonlocal and not located in space or time (or rather is everywhere at once), hence has all the characteristics of mind. Wavefunction collapse is, therefore, a continual collaboration between the material domain (particles) and the mental domain (wavefunctions of particles). Wavefunction collapse followed by wavefunction reformation is a continuous and eternal process: the mathematical interface between mind and matter. Mind does not have to be brought into quantum mechanics from outside. It's already integral to quantum mechanics!

As for Bell's comments regarding Lorentz invariance and the mind, he's mischaracterising the mind. The mind is a monad. At one level, it is a single point in space and time, exactly as Bell requires for Lorentz invariance of the mind, but, of course, as a dimensionless point, it's not actually in space and time at all. It's nonlocal. It's everywhere at once, connected to the whole universe.

A point is an extraordinary thing because it's dimensionless, yet dimensionality is based on it. How do you draw a one-dimensional line? You start by placing the point of your pencil on a piece of paper to create a dimensionless point, and then you move your pencil in a particular direction, and all you're doing is adding more dimensionless points to your original point, and by the end you have drawn your one dimensional line.

Even great thinkers like Bell can't make any progress with the mind until they define it correctly: as a mathematical point, as a Leibnizian monad. Moreover, it is the brain (a physical entity), that is the mind's agent or proxy in the physical world. The brain's collective wavefunction is its mind – which is ultimately traced back to a single controlling monad (the soul). When we die, our brain (and the rest of our body) turns to dust, but the controlling monad goes on since it's imperishable and immortal, being outside space and time.

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“One of the things that I specifically wanted to do was to see whether there was any real objection to the idea put forward long ago by de Broglie and Bohm that you could give a completely realistic account of all quantum phenomena. De Broglie had done that in 1927, and was laughed out of court in a way that I now regard as disgraceful, because his arguments were not

refuted, they were simply trampled on. Bohm resurrected that theory in 1952, and was rather ignored. I thought that the theory of Bohm and de Broglie was in all ways equivalent to quantum mechanics for experimental purposes, but nevertheless was realistic and unambiguous. But it did have the remarkable feature of action-at-a-distance. You could see in the equations of that theory that when something happened at one point there were consequences immediately over the whole of space unrestricted by the velocity of light.” – John Bell

This is a classic example of the establishment paradigm crushing a rival, but not through science, evidence or reason; simply through ideology, fashion and the personalities and profile of the protagonists. De Broglie was no match for superstars like Bohr and Heisenberg. Scientific careerists followed the establishment view of the two gods, while De Broglie’s ideas were left to rot. If science were a proper science (!) it wouldn’t simply dismiss unfashionable positions, but would seek to explore all possible avenues and see what emerges. The way science works is that science departments appeal for funding (provided by the establishment) and scientists themselves want to be working in fashionable areas in order to advance their careers. Funding isn’t provided to anti-establishment projects, and scientists don’t want to work in “unsexy” areas, so the effect is to turn science into a fashion parade and a vehicle for the dogmatism and ideology of the establishment.

Science does not function as it likes to think. If it did, it would be actively and systematically supporting research into ALL viable theories in order to test which ones were the most robust scientifically. Instead, it pursues a kind of X-Factor or American Idol approach where some “singers” (theories) fall by the wayside by popular vote even though they may be better than the eventual winners. Science is a popularity contest like everything else. It has a priesthood, a political stance, an establishment, an ideology and dogma – just like religion.

Einstein: Ether and Relativity

In 1920, Einstein gave an address at the University of Leiden on the topic “Ether and the Theory of Relativity”. This is given almost none of the widespread attention it deserves given that, in it, Einstein practically resurrects the ether from the grave in which he himself placed it. We have highlighted in bold the statements where he defends an ether hypothesis as

being compatible with his relativity theory. In essence, his special theory of relativity dispenses with the ether and then his general theory of relativity brings it back again (although the physics community rarely mentions this return from the dead). Einstein's analysis is brilliant, yet also reveals the absolute ambiguity that continues to surround the subject of the ether, and to which physics has found no solution. The nature of the ether is one of the most important questions in physics – because if you cannot define the stage then where will you place the actors, and how can they interact?

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“More careful reflection teaches us however, that the special theory of relativity does not compel us to deny ether. We may assume the existence of an ether; only we must give up ascribing a definite state of motion to it, i.e. we must by abstraction take from it the last mechanical characteristic which Lorentz had still left it.” -Einstein

“the hypothesis of ether in itself is not in conflict with the special theory of relativity. Only we must be on our guard against ascribing a state of motion to the ether. Certainly, from the standpoint of the special theory of relativity, the ether hypothesis appears at first to be an empty hypothesis.” -Einstein

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“...But on the other hand there is a weighty argument to be adduced in favour of the ether hypothesis. To deny the ether is ultimately to assume that empty space has no physical qualities whatever. The fundamental facts of mechanics do not harmonize with this view. For the mechanical behaviour of a corporeal system hovering freely in empty space depends not only on relative positions (distances) and relative velocities, but also on its state of rotation, which physically may be taken as a characteristic not appertaining to the system in itself. In order to be able to look upon the rotation of the system, at least formally, as something real, Newton objectivises space. Since he classes his absolute space together with real things, for him rotation relative to an absolute space is also something real. Newton might no less well have called his absolute space “Ether”; what is essential is merely that besides observable objects, another thing, which is not perceptible, must be looked upon as real, to enable acceleration or rotation to be looked upon as something real. It is true that Mach tried to avoid having to accept as real something which is not observable by endeavouring to substitute in mechanics a mean acceleration with reference to the totality of the masses in the universe in place of an acceleration with reference to absolute space. But inertial resistance opposed

to relative acceleration of distant masses presupposes action at a distance; and as the modern physicist does not believe that he may accept this action at a distance, he comes back once more, if he follows Mach, to the ether, which has to serve as medium for the effects of inertia. But this conception of the ether to which we are led by Mach's way of thinking differs essentially from the ether as conceived by Newton, by Fresnel, and by Lorentz. Mach's ether not only conditions the behaviour of inert masses, but is also conditioned in its state by them. Mach's idea finds its full development in the ether of the general theory of relativity. According to this theory the metrical qualities of the continuum of space-time differ in the environment of different points of space-time, and are partly conditioned by the matter existing outside of the territory under consideration. This space-time variability of the reciprocal relations of the standards of space and time, or, perhaps, the recognition of the fact that "empty space" in its physical relation is neither homogeneous nor isotropic, compelling us to describe its state by ten functions (the gravitation potentials g_{mn}), has, I think, finally disposed of the view that space is physically empty. But therewith the conception of the ether has again acquired an intelligible content although this content differs widely from that of the ether of the mechanical undulatory theory of light. The ether of the general theory of relativity is a medium which is itself devoid of all mechanical and kinematical qualities, but helps to determine mechanical (and electromagnetic) events. What is fundamentally new in the ether of the general theory of relativity as opposed to the ether of Lorentz consists in this, that the state of the former is at every place determined by connections with the matter and the state of the ether in neighbouring places, which are amenable to law in the form of differential equations; whereas the state of the Lorentzian ether in the absence of electromagnetic fields is conditioned by nothing outside itself, and is everywhere the same.

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As to the part which the new ether is to play in the physics of the future we are not yet clear.

If we consider the gravitational field and the electromagnetic field from the standpoint of the ether hypothesis, we find a remarkable difference between the two. There can be no space nor any part of space without gravitational potentials; for these confer upon space its metrical qualities, without which it cannot be imagined at all. The existence of the gravitational field is inseparably bound up with the existence of space. On the other hand a part of space may very well be imagined without an electromagnetic field; thus in contrast with the gravitational field, the electromagnetic field seems to be

only secondarily linked to the ether, the formal nature of the electromagnetic field being as yet in no way determined by that of gravitational ether. From the present state of theory it looks as if the electromagnetic field, as opposed to the gravitational field, rests upon an entirely new formal motif, as though nature might just as well have endowed the gravitational ether with fields of quite another type, for example, with fields of a scalar potential, instead of fields of the electromagnetic type. Since according to our present conceptions the elementary particles of matter are also, in their essence, nothing else than condensations of the electromagnetic field, our present view of the universe presents two realities which are completely separated from each other conceptually, although connected causally, namely, gravitational ether and electromagnetic field, or – as they might also be called – space and matter. Of course it would be a great advance if we could succeed in comprehending the gravitational field and the electromagnetic field together as one unified conformation. Then for the first time the epoch of theoretical physics founded by Faraday and Maxwell would reach a satisfactory conclusion. The contrast between ether and matter would fade away, and, through the general theory of relativity, the whole of physics would become a complete system of thought, like geometry, kinematics, and the theory of gravitation.

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Recapitulating, we may say that according to the general theory of relativity space is endowed with physical qualities; in this sense, therefore, there exists an ether. According to the general theory of relativity space without ether is unthinkable; for in such space there not only would be no propagation of light, but also no possibility of existence for standards of space and time (measuring-rods and clocks), nor therefore any space-time intervals in the physical sense. But this ether may not be thought of as endowed with the quality characteristic of ponderable media, as consisting of parts which may be tracked through time. The idea of motion may not be applied to it.

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In *Black Holes, Wormholes & Time Machines*, Jim Al-Khalili wrote, “But if space is not a substance, can we interact with it? Can matter affect it in some way? It turns out that matter can indeed affect space itself: it can bend it!” Al-Khalili also says, “[I] will assume that although space is not a substance, it must nevertheless be something!” Al-Khalili was writing some 80 years after Einstein’s Leiden lecture. While we have Einstein saying that space is endowed with physical quantities, we have Al-Khalili saying that space is not

a physical substance, yet it can be bent. Einstein said that ether does exist in some sense. Al-Khalili wrote that experiments performed at the end of the 19th century proved beyond any doubt that the ether does not exist. Confusion reigns. Ether does and does not exist. Space is endowed with physical properties yet is not a physical substance, though it can be bent. WHAT?! How can you bend a non-substance? Here we see the catastrophic lack of philosophical literacy that bedevils physicists. They make outrageous statements, and see no serious problems with what they have said. We would be appalled if we had to defend the concept of a non-physical substance that bends. Physicists clearly aren't troubled. (We should point out that we're not singling out Al-Khalili; he is simply reflecting the position of all physicists.)

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-Einstein

This, in fact, goes right to the heart of the matter. Is the essential framework of physics based, finally, on an imperceptible stage – an invisible, permanently unobservable Cartesian Arena, not of absolute space and absolute time as Newton maintained, but in fact absolute spacetime? EVERYTHING in physics makes sense if that's true. Physics makes no sense otherwise. But physics has established itself as a dogmatic ideology of materialism and empiricism. It cannot, within the terms of its own paradigm, accept an unobservable, perfect mathematical stage that solves all of the problems of physics but contradicts the currently accepted paradigm. Yet the way out is simple. Physicists have to abandon scientific empiricist materialism and accept a new paradigm (or rather a 300-year-old forgotten paradigm): the scientific rationalist idealism of the ultimate genius – Leibniz.

The reason why the “ether” isn't observable is that it isn't physical, it's mental. As soon as that single fact is grasped, the materialist paradigm falls and is replaced by idealism. Just as importantly, empiricism – though certainly not rendered redundant – must bow to rationalism regarding fundamental issues beyond the reach of the senses, experience and

experiments, but fully accessible to reason. For science to make any further substantive progress, this revolutionary change in its central paradigm must take place. M-theory – which is the culmination of decades of the work of some of the greatest scientific minds of the age – is getting nowhere. It cannot succeed. It is the final attempt of materialists to save their ideology, yet that ideology is wrong and incapable of being rescued.

Once scientists accept that idealism allows a perfect mathematical stage to be constructed, they will see that one intractable problem after another simply falls away and science is replaced by ontological mathematics: the mathematics of a living (but unconscious) cosmic mind made up of infinite unitary minds that Leibniz labelled monads.

Scientific empiricist materialism is about ad hoc theories and experiments. Scientific rationalist idealism is about analytic, immutable, eternal mathematical laws, devoid of any provisionalism or imperfection. Mathematics offers definite solutions to all the conundrums of existence; science does not. Only when we replace science with ontological mathematics – the mathematics of existence – can we finally master the knowledge of the universe.

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The last proper scientist was Leibniz – a rationalist idealist rather than empiricist materialist. Leibniz had no fear of unobservables. His entire philosophy was based on them. Leibniz's calculus – the most powerful tool ever discovered by the human mind – came about wholly through the consideration of unobservables. Leibniz was unafraid of metaphysics and saw no contradiction between science and metaphysics. In fact, he didn't think that non-metaphysical science was coherent. "Nature must always be explained mathematically and mechanically, provided it is remembered that the principles themselves, or laws of mechanics or force, do not depend on mathematical extension alone, but on certain metaphysical reasons." – Leibniz

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Never forget that 99.99999999999999% of the atom is empty space. Never forget that the universe is mostly the near-vacuum of outer space. Imagine

stripping out of all of the sensory data from the universe: colours, sights, sounds, smells, tastes, touch. What's left? Just mathematical operations taking place in absolute darkness. The universe is nothing but an information ocean – of mathematical signals, being processed by minds and converted into sensory information. Why did anyone ever believe it was a place of scientific phenomena rather than mathematical phenomena?

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